EXPANDED TECHNICAL ASSISTANCE PROGRAM

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Report to the Government

of the

UNITED ARAB REPUBLIC

on

PLANT DISEASES OF ECONOMIC IMPORTANCE IN THE NORTHERN REGION

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

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REPORT TO THE GOVERNMENT
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PLANT DISEASES OF ECONOMIC IMPORTANCE IN
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By

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CONTENTS

I. INTRODUCTION

In accordance with the Government's request for technical assistance in the investigation and control of major plant diseases, the Food and Agriculture Organization of the United Nations, under its Expanded Technical Assistance Program, appointed Dr. D. Mulder as an expert in plant pathology with headquarters in the Northern Region, the United Arab Republic. The expert served from 1 August 1956 to 31 July 1958.

After the expert's arrival at Damascus in September 1956, it was agreed by the Ministry of Agriculture that attention should be first given to nutritional disorders and virus diseases, especially those of fruit trees. Most of the important horticultural areas were visited, some of them several times. The irrigated area around Damascus and the fruit-growing area of Zebedani were intensively investigated. The expert acknowledges with gratitude the most hearty collaboration and the hospitality of the farmers he met in these areas.

Due to shortage of transport facilities in the autumn of 1957 and military restrictions on travel afterwards, the expert's work in other regions was very much impeded.

Owing to the lack of laboratory space for plant pathological work, only very limited laboratory investigations were possible. The absence of a greenhouse for virus work prevented the exact identification of the many virus diseases encountered.

During his assignment, the expert received the kind cooperation of the Director and other staff members of the Agricultural School at Kharabo for work on virus diseases of fruit trees.

He is indebted to Dr. A. Sharif for the assistance in mycological work and leaf analysis. The interest of and cooperation given by Mr. Sh. Shaheen is also gratefully acknowledged.

Three local scientists, Mr. T. Khalife, Mr. Ismat Abdul Hamid, and Mr. Badia Husseini acted successively as the counterparts of the expert and their helps in various ways were invaluable. The expert also wishes to acknowledge the assistance in the identification of some diseases and parasitic fungi given by Dr. J.P.H. van der Want, Wageningen, the Netherlands, Dr. E.L. Reeves, U.S.A., Dr. P.A. von Arx, Baarn, the Netherlands, and Dr. F.O. Smith, Beirut.

II. SUMMARY OF RECOMMENDATIONS

The Need for Adequate Working Facilities

1. The lack of laboratory and greenhouse facilities was the main reason that the expert's work had been restricted to disease survey and that he could not undertake some experiments which would have yielded useful results. However, in order to prevent the great losses due to plant diseases, it would be necessary in the immediate future to carry out some experiments on disease control in connection with the use of chemical treatments, the development of resistant varieties and the improvement of cultural practices. To this end, it is recommended that a laboratory for phytopathological investigations be established in an agricultural area as a unit of an agricultural research station. The laboratory should be staffed with competent plant pathologists and provided with greenhouses and experimental fields.

The Need for an Extension Service

2. In order to introduce to the farmers knowledge concerning plant diseases and their control, there is an urgent need for an extension service which should have sufficient trained personnel in the field. A series of booklets on the control of the more important diseases should be prepared for the use of extension agents.

3. Some of the larger manufacturers or distributors of fertilizers and plant protection products have developed propaganda programs for their own products. While such programs could have beneficial effects, the farmers would be left in the hands of people with biased interests if these were the only source of advices.

4. Instead of supplying government-owned spraying equipment to individual farmers for use on their farms, it is suggested that such equipment should be used by government agencies for demonstration purpose.

5. The orchard of the Agricultural School at Kharabo should be used for demonstration in methods for disease control; similar demonstration plots should also be made available in the Zebedani valley and in other agricultural areas.

Training of Technical Personnel

6. The region is much in need of trained plant pathologists. To meet this requirement, the Government should arrange as soon as possible for several promising agricultural graduates to be sent abroad for

specialized training in plant pathology. At least one of them should be permitted to receive adequate advanced training in order that on his return he may carry out some of the urgently needed investigations.

7. The field personnel in plant protection should meet at least once a year to report on the current situation in their respective areas and to obtain information on recent advances in the control of plant diseases and related subjects.

Control of Plant Diseases

8. Since viruses and nematodes appear to be the two important causes of plant diseases in the Region , future investigations should give emphasis on the control of diseases of such origins.

9. For the control of virus diseases, attention should be given to the use of virus-free seed, the control of insect vectors and the control of weeds which may carry the virus.

10. The use of appropriate cultural measures can often be an effective means for reducing disease losses. Since it involves little cost and can be readily accepted by farmers, special efforts should be made to introduce such methods into practice. For instance, the use of a proper cover crop like alfalfa and the avoidance of excessive irrigation in spring, together with more liberal application of manure , could help reduce iron deficiency in fruit trees. Some cultural practices are also recommended in this report for the control of Rhizoctonia disease of potato.

11. Peach trees showing symptoms of peach yellows should be eradicated as soon as possible.

12. For the effective control of wheat bunt, the Government should take over the responsibility for the disinfection of seed.

13. To prevent the introduction of destructive diseases of potato, seed potatoes to be imported should be inspected in the country of origin by an official of the United Arab Republic.

14. Measures for the control of certain diseases are discussed in this report under individual diseases.

III. PLANT DISEASES OF ECONOMIC IMPORTANCE

In the Region of Syria, nutritional disorders and virus diseases are prevalent in fruit trees and virus symptoms are very frequently observed in vegetables. Fungus diseases, on the other hand, appear to be in general prevented to a large extent by climatic conditions. Some fungi can cause serious damages even in dry areas, whereas others are restricted to areas with high rainfall and some are favored by heavy irrigation.

Nutritional Disorders

Judging from the characteristics of plant growth, the major nutritional elements are as a rule available in soil in such quantity that deficiency symptoms rarely develop. This does not mean that the application of fertilizers is not needed. On the contrary, due to the low content of organic matter, much nitrogen fertilizer is required. Many soils are low in phosphorous content, but as a rule there is enough potash available. On the other hand more attention must be paid to minor elements.

Magnesium, however, is deficient in many places. Citrus trees near Lattakia showed clear symptoms of magnesium deficiency as also did apple trees near Zebedani. Some vegetables and garden plants near Damascus showed chlorosis of the lower leaves as a result of magnesium deficiency. It is therefore recommended that magnesium sulfate be used in these cases until symptoms have disappeared and that if potash is needed a potash fertilizer which contains magnesium be applied afterwards.

Due to high pH and high lime content of the soil, severe symptoms of iron deficiency develop readily if other favorable factors are also present. In particular, poor aeration of the soil due to the soil structure (low organic matter content) and excessive irrigation applied too early in spring are the common factors conducive to iron deficiency.

In the spring of 1957, some experiments were carried out by the Horticultural Expert and the writer to correct the iron deficiency with organic iron compounds (Sequestrene NaF and Greenz). Although considerable improvement in green color of apple and pear foliage was obtained, the result was not quite satisfactory. During the 1957

season, more observations were undertaken and a conclusion was reached that iron deficiency as it occurs in the fruit growing area around Damascus and near Zebedani could be cured to a great extent by having a proper cover crop and applying irrigation only at the time when water is really needed. In particular, the observation that many trees showing severe chlorosis in spring have a much better leaf color in summer led the experts to believe that too much irrigation is one of the causes of chlorosis. Therefore, instead of continuing to experiment with organic iron compounds, more emphasis should be given to the introduction of appropriate cultural measures on soils that tend to give rise to severe iron deficiency.

Symptoms of zinc deficiency occur in most of the fruit growing areas of Syria. They were found on citrus trees near Lattakia and on apple trees in the following places :

1. Near Soueida, on variety Golden Delicious.
2. Near Kafer in state nursery, on Golden Delicious.
3. Near Majdel Chems.
4. In orchard south of Syrian Glass Factory (south of Damascus).
5. Near Nebek.
6. Near Zebedani, on Golden Delicious (three orchards).
7. In Agricultural School near Kharabo.

It is not yet clear what soil conditions cause this deficiency. It may be that phosphates used as artificial fertilizers have an influence on the availability of zinc. But no relation with over-irrigation was found. The use of a cover crop like alfalfa is the best solution to this problem. In the meantime, a spray of 5 percent zinc sulfate before bud development can be used as a direct cure. After blossom time a spray of 1.5 percent zinc sulfate plus 0.75 percent lime may be applied.

In two cases, trees were suspected of having symptoms of boron deficiency. Near Lattakia, olive trees were found to be suffering from a dieback on a poor eroded and very calcareous soil. In the same area south of Lattakia, near Djeble, citrus trees were also found to be suffering from dieback. It is not yet clear whether boron deficiency was the cause. Samples were taken and sent to the American University in Beirut for analysis of boron.

Virus Diseases of Fruit Trees

Peach. Peach yellows was found for the first time in the orchard of the Agricultural School at Kharabo. Later the symptoms were observed in many orchards near Damascus and also in three orchards in the Zebedani Valley. The symptoms varied somewhat, depending on the type of soil on which the tree was grown. Trees standing on highly calcareous soil showed more yellowing in the advanced stages of the disease. The first symptom occurred at the end of the growing season on the tops of new shoots. An affected top was split into several branches - a beginning of the witches' broom growth. The leaves on an affected top were abnormally small in comparison with normal leaves on lower parts of the same shoot. Trees with older infection show a much reduced growth with leaves in pale color. In the final stage of the disease, many branches were dead and only some tufts of yellow broom-like twigs remained on some of the bigger branches. It was recommended that a survey should be made of all diseased peach trees and that their eradication should be made obligatory.

Peach, plum and apricot trees were inoculated with peach yellows by budding but symptoms were shown only on peach trees.

Plum. On plum trees three types of virus symptoms were found. It is probable that they are due to infection of :

1. prune dwarf virus
2. leaf rolling virus
3. bark split virus

Experimental work on their identification was initiated, using budwood of two introduced indicator varieties (Italian prune and Cambridge Gage). The work was not completed when the expert left Syria.

Apricot. No virus disease of economic importance seems to occur on apricot. One type of symptoms appeared commonly, probably due to the infection of asteroid spot virus which has been recorded on peach in Palestine. Identification of this disease by transmission to peach and plum was initiated but not completed. Seedling apricots (Kelabi) was found to be free from symptoms. Variety Baladi was almost completely infected. Three other varieties known as Hamwi, Wazari and Ajami were also infected, but apparently to a lesser extent.

Cherry. Some wild symptoms of ringspot were found. The prevailing high temperature probably prevented the development of clear symptoms. Crinkle occurred on some cherry trees in the Agricultural School at Kharabo.

Some sour cherries were suspected of having sour cherry yellows.

Apple. Symptoms of apple mosaic were not found in Syria. Some Italian Gravenstein trees in the orchard of the Agricultural School at Kharabo showed mild symptoms of flat limb on the trunk near the ground and much reduced growth. The diseased trees should be eliminated. Gravenstein from the United States was healthy.

Pear. Some vein clearing was found on young trees.

Fig. Fig mosaic is probably present in every fig orchard. Severe symptoms resulting in dwarfing of the trees were observed in different places. A start was made with the selection of what might be resistant plants in a field of severely infected seedlings in the Sinn nursery near Lattakia. Ten seedlings were marked for transplantation to a special plot. This project has been continued by the Director of the State Nursery at Sinn.

Mulberry. Almost all mulberry trees showed vein banding on a certain group of leaves of similar age on affected branches. In many cases the symptom developed into chlorosis. On first view it appeared to be caused by aphid feeding but there were cases where it might be concluded that they were caused by a virus. In some cases the chlorosis was so severe that it looked as if iron deficiency was the cause. Observations at a stage when the leaves are developing will probably give more information as to the cause of this disorder.

Citrus. No clear virus symptom was found on citrus tree leaves. Some "scaly bark" was apparent in groves near Lattakia. This symptom appeared identical with psorosis B symptom, although it was not confirmed by transmission experiments.

Virus Diseases of Vegetables

Squashes. Cucumber mosaic occurred commonly in squashes, with the results that the growth of the crop was seriously reduced. Early and heavy infection was noted in the fields immediately around Damascus, but in a field at Kharabo the infection appeared much later and only

to a limited extent. The difference is apparently due to the fact that the field at Kharabo was isolated and there were less weeds in the vicinity. The following measures are recommended for the control of this disease :

1. The use of virus-free seed.

2. The elimination of first infected plants in the spring.

3. The eradication of weeds which might act as hosts of the virus, in the vicinity of squash fields.

4. The treatment of plants with insecticides to prevent the spread of the virus by insects.

5. The use of resistant varieties.

Tomato. The common virus diseases of tomato do not seem to occur to any extent in Syria. The fern leaf symptom due to the infection of cucumber mosaic virus was seen only once.

Swiss Chard (Beta vulgaris var. cicla). In most fields of Swiss chard (Sellik) around Damascus, a heavy infection of a virus disease was noticed. The symptoms resemble those of beet mosaic, although there is the possibility that it may be cabbage black ringspot. The virus was experimentally transmitted to tobacco.

The first symptoms consisted of yellow spots on leaves which might be the direct result of infection, probably by some insects. The disease then appeared on younger leaves, with the result that growth was stunted and chlorophyll formation was reduced. The leaves became twisted with a wavy margin, and some of them were so deformed that they appeared much narrower than normal with margins rolled backward.

Diseased plants were not evenly distributed in a field, but they were concentrated along the border. This suggests spread by an insect. Only in very severely affected fields the diseased plants occurred throughout the plot.

Cos Lettuces. Cos lettuces are the varieties most commonly grown around Damascus. It was noticed that some plants were dwarfed with vein clearing in leaves resembling the symptoms of the big vein disease of lettuce described from the United States, whereas other dwarf plants showed mosaic in leaves.

Fungus Diseases of Fruit Trees

Apple scab (Venturia inaequalis) occurs only in the Zebedani Valley where environmental conditions are favorable for the disease and control measures still insufficient. The same holds true for apple mildew (Podosphaera leucotricha). Around Damascus, both diseases were not found to be serious.

On pear trees on the mountains near Lattakia, pear rust (Gymnosporangium sabinae) occurs. From dead bark of pear trees near Damascus, a species of Cytospora was isolated.

Pistachio trees near Aleppo suffer greatly from an attack of Phleospora pistaciae (?). The perithecial stage of this fungus develops in spring on fallen leaves on the ground. No control measures have been tried so far.

It is recommended that the life cycle of the fungus and the epidemiology be studied in order to determine an appropriate time schedule for the application of fungicides.

Fig trees near Lattakia show early defoliation due to the fig rust (Physopella fici). A bark canker on the trunk was found on numerous trees in the north.

Quince trees in the Zebedani Valley suffer badly from a Sclerotinia attack of flowers before and during blossom time. The fungus was isolated and sent to Wageningen for identification. From observations on the development of blighted flowers, the blighting due to the infection was found to take place at the beginning of April. Trials on the control of this disease by spraying with fungicides failed to yield satisfactory results, probably because the 10 days intervals between treatments adopted were rather too long to protect the trees effectively. Besides, mummified fruit and dead twigs remaining on the tree served as a constant source of infection. Therefore to control this disease effectively, sanitation and pruning should be practiced, in addition to chemical treatment.

Judging from the appearance of trees in the experimental orchard, in addition to Sclerotinia disease, insects (mainly a leaf-roller) and frosts caused much damage. All these would require more adequate control

Apricot trees suffer often from an attack by the root fungus Verticillium dahliae causing wilting of part of the tree. As tomato is also a host of this fungus, it is not advisable to grow tomato plants under apricot trees. In the neighborhood of Homs, Sclerotinia cinerea was found on apricot trees in the state nursery.

Peach shot-hole caused by Clasterosporium carpophilum is a serious disease in some orchards. No control of this disease has been attempted. The standard control measure is the application with Bordeaux mixture after leaf fall.

Young almond trees were found in 1957 to be infected by the plum rust Puccinia pruni-spinosae.

On grapes, both powdery mildew (Uncinula necator) and downy mildew (Plasmopara viticola) are present, but only occasionally they cause serious damage.

Fungus Diseases of Vegetables

Potatoes suffer badly from three diseases, namely, Rhizoctonia disease, Colletotrichum root rot, and Fusarium tuber rot.

1. Rhizoctonia solani was found in all the main potato-growing areas, causing great losses due to the early death of affected plants. The fungus was repeatedly isolated from affected tubers and stolons. The destructiveness of this fungus lies not so much in its damage to the tubers as in the fact that it kills the stolons on which new tubers are to be formed. Sclerotia of the fungus are carried by new tubers and when such tubers are used for planting the disease spreads. Therefore, a program should be organized by the Government to enforce the disinfection of seed potatoes. However, for effective control of the disease, it is more important to introduce changes in cultural practices directed towards improvement of soil conditions. This can be achieved by :

a. Growing potatoes on ridges instead of on flat land to obtain better soil aeration.

b. Limiting irrigation to the strictly necessary amount.

c. Planting seed as late as possible in order to promote rapid development of shoots thus lessening risk of disease.

d. Harvesting early to reduce infection.

e. Limiting the use of fresh manure, as the parasite can live saprophytically on organic matter.

f. Carrying out crop rotation in a 4-6 years' cycle.

Under the present circumstances in Syria, it might be worthwhile in the case of seed potatoes imported from Europe to use only seed potatoes which are very slightly infected with Rhizoctonia or which have been disinfected in the country of origin.

2. Colletotrichum atramentarium, which attacks especially the stolons, was found to be particularly severe in the area of Serraya. The fungus was cultured from sclerotia on diseased stolons. As means of control, all infected material should be burnt after harvesting and crop rotation should be practiced.

3. A dry rot of tubers that may be of importance is caused by Fusarium sp. In the area of Serraya the dry rot seemed to follow the infection of the stolons by Colletotrichum.

Tomatoes were found to be attacked to a limited extent by a root rot due to a species of Fusarium. Wilting due to Verticillium was also noticed.

On cauliflower powdery mildew (Erysiphe polygoni) was observed.

The other main vegetables, like Swiss chard, cabbage, onions, and beans, were on the whole free from parasitic diseases.

Fungus Diseases of Other Crops

Wheat. Bunt or stinking smut caused by Tilletia caries is still the most important disease of wheat in Syria. Loose smut caused by Ustilago tritici is also present, but to a much lesser extent. Although the losses due to these diseases were estimated to amount to as much as 20 percent of the harvest in average, no special measures have been taken to reduce the losses. It would be advisable for the Government to organize a program for the disinfection of seed grain against smuts.

Stem rust of wheat (Puccinia graminis) was found incidentally, but was of little importance in the main wheat-growing areas.

Poplar. Young poplar trees of the "Hamwi" type were found dying in two nurseries because of a bark rot near the ground level caused by Cytospora chrysosperma. This disease is probably favored by high air humidity near the ground as a result of excessive irrigation and growth of grasses and weeds around the trees. The application of a copper spray in spring and the improvement of the physical conditions of the soil might be helpful. Poplar rust (Melampsora pinitorqua) often causes severe loss of the foliage.

Diseases of Other Causes

Grapes were found to be commonly infected on stems with crown-gall caused by Agrobacterium tumefaciens. An experiment using Elgetol (sodium salt of dinitro-cresol) for treating the affected stems, was made but such a treatment appeared to cause severe injury of the host plants, resulting even in their death.

Outside the oasis of Palmyra, a heavy infection of tomato plants by the root knot nematode, Meloidogyne sp., was found in the autumn of 1956. In march 1957, an experiment on disinfestation of the soil with DD was carried out by the Plant Protection Service, but no conclusive results were obtained. Since chemical treatment of soil is so costly and cannot be adopted by farmers in Syria, crop rotation will probably be the only method to reduce losses.